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ABSTRACT

This study is based on a questionnaire survey of teachers trained over a three-year period in a program centered at the University of Wyoming, the Portal School Project (PSP), and a similar survey of a random sample of teachers in Rocky Mountain States neighboring the region served by the PSP. Teachers were asked certain demographic questions and if they had used certain National Science Foundation (NSF) curricula for each semester between 1970 and 1974. They were also asked to rate their level of usage of the curricula. Possible urban-rural differences, cross-year differences, and junior-senior high differences for secondary curricula were investigated. Use of NSF curricula was about 40% for elementary and 68% for secondary curricula. The PSP group tended to use the NSF curricula longer than the control sample. (Author/BB)

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RESEARCH PAPER #21

Five-Year Usage Patterns for NSF Sponsored Science Curricula

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FIVE-YEAR USAGE PATTERNS FOR NSF SPONSORED SCIENCE CURRICULA[1]

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Introduction

While a number of studies have been concerned with the usage rate by teachers of NSF sponsored science curricula at any given time, no direct information is known about the usage of these curricula over time. How often do teachers use curricula such as AAAS, BSCS, or BCS? This study reports the number of semesters teachers utilize selected elementary and secondary NSF science curricula in a five-year period. Teachers specifically trained in the NSF curricula are compared with a sample from a control region similar to that of the trained teachers. In addition, general decay curves for curricula usage are reported, showing the percentage of teachers expected to utilize curricula over a four and one-half year period after initial adoption.

The study is based on a questionnaire survey of teachers trained over a three-year period in a program centered at the University of Wyoming--the Portal School Project (PSP)--and a similar survey of a random sample of teachers in Rocky Mountain states neighboring the region served by the PSP (Wyoming, eastern Colorado, southern Montana). Teachers were asked demographic questions and if they had used certain NSF curricula for each semester between 1970 and 1974. They were also asked to rate their level

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of usage of the curricula, from full implementation to use as supplements. Both elementary and secondary teachers were surveyed.

Three variables are of primary interest. First is length of usage, defined as the number of semesters between fall 1970 and fall 1974 that curricula were used. The second variable is weighted length, usage weighted by a fraction representing level of use from full (1.0) to none (0.0). The third variable is decay rate, the percentage of teachers expected to use a curriculum for a given length of time after initially implementing. The comparison of teachers trained in the curriculum with a general population provides data concerning the effects of specific training on length of usage. Additional variables of interest were possible urban-rural differences, cross-year differences, and junior-senior high differences for secondary curricula.

Literature

The author was unable to find specific studies which have looked at curriculum maintenance. The usage rates for various NSF curricula for a given year are reported by Schlessinger, et al. (1973) in which estimates for the Rocky Mountain region for curriculum usage are provided. Bracht (1973) reported usage rates for the Portal School Project based on an evaluation of the project.

An item related to persistence is the textbook adoption cycle used in school districts. As part of a baseline data collection for a large scale evaluation project, Welch and Gullickson (1973) collected information on textbook adoption in five Rocky Mountain states.* Results indicated a five-year cycle which appears to be typical across the country.

*Colorado, Idaho, Montana, Utah, and Wyoming.

Method

Subjects

A list of all courses taught under the Portal School Project between 1970 and 1973 was obtained, along with the names and addresses of class members. Over 2,200 teachers participated during that time at local Portal School courses taught throughout Wyoming, in northeastern Colorado (including Denver), and in southern Montana. A stratified sample was constructed, with strata being year attending a class (1970-1971, 1971-1972, or 1972-1973), elementary or secondary level of instruction, and urban or rural location of the course. Denver was the major urban center. A total of 522 teachers was drawn as a sample at random from the strata. The sample sizes are given in Table 1. The number chosen was based on a 50% expected response rate. The length of time elapsed since conduct of the workshops was expected to produce a low rate because of change of address, disinterest, retirement, etc.

Due to the extensive activity in the PSP impact region, a control area was defined as surrounding states with similar characteristics: Montana, Idaho, eastern Washington, and northern Utah. Education directories were obtained for these states and urban areas defined: Spokane, Washington; Great Falls, Montana; and Salt Lake City, Utah. It was felt that these cities have characteristics in common with Denver and are distinct from the typical western rural town. Since individual teachers' names were not accessible, the principal of a school selected within strata of urban-rural and elementary-secondary was sent the questionnaire with instructions to select a science teacher from his staff at random. Junior and senior high schools were selected separately to insure representation. A total of 527 schools were sent the questionnaire on January 17, 1975 (see Table 1).

TABLE 1

Sample Size and Response Size and Rate for
Portal School Teachers and Control Region Teachers

Stratum	Sample Size	Number Returned Undeliverable	Number Received	Effective Response Rate %
Portal School				
1970 Elementary				
Rural	50	6	16	36
Urban	37[a]	7	14	47
1971 Elementary				
Rural	50	8	16	38
Urban	50	15	18	51
1972 Elementary				
Rural	50	2	27	56
Urban	50	6	21	48
1970 Secondary[b]				
Rural	35[a]	6	16	55
1971 Secondary				
Rural	50	7	24	55
Urban	50	8	23	55
1972 Secondary				
Rural	50	6	26	59
Urban	50	5	29	56
		14[d]		
TOTAL	522	90	226	52
Control Region				
Elementary				
Rural	149	0	57	38
Urban	150	0	64	43
Secondary				
Rural				
Jr High	101	0	57	56
Sr High	51	0	26	51
Urban				
Jr High	47[c]	0	32	68
Sr High	29[c]	0	18	62
TOTAL	527	0	254	48

[a] Total number participating
[b] No urban secondary teachers participated
[c] Total number of schools available
[d] Deceased, retired, never taught school

One month after initial mailings, a second mailing was made to all PSP teachers who had not yet responded. This resulted in improved response rates, which are also given in Table 1. Among the PSP teachers, 90 questionnaires were returned by the Postal Service as undeliverable. These were not replaced, so the effective response rate is based on 432 teachers. No follow-up was made in the Control Region to avoid antagonizing school principals and teachers.

The consistent number of non-deliverable questionnaires across PSP strata suggests a stability in the samples. Also, response rates are poorer for early participants than for recent participants, as expected.

Instrument Construction and Mailing

The questionnaire mailed to teachers consisted of two joined pages with three sides containing questions. Demographic questions were asked, along with questions about the teacher's opinions of three NSF curricula (AAAS, ESS, and SCIS for elementary teachers; BSCS, ESCP, and ISCS for secondary teachers). The curricula were selected for their widespread use and because of the emphasis placed on them in the PSP. For each fall and spring semester from 1970 until fall 1974, teachers were asked if they taught each NSF curriculum and at what level they used each one. Full usage was defined as exclusive use of the curriculum; high as primary use of the curriculum but with other sources accounting for up to 50% of the content; low usage was defined as supplementary use of the curriculum only.

Addressed, stamped envelopes were provided for all survey members. A cover letter asked for teachers' cooperation and contained a brief explanation of the purpose of the study. The follow-up to Portal School teachers included the original material and a second cover letter. This mailing took place on February 19, 1975.

Results

Description of the Two Groups

In addition to the sampling strata, the teachers in the Portal group and Control group differ only in the percent who have obtained an M.A. degree (42% for Portal, 52% for Control; $z = 2.19$, $p < .01$). The number of years teaching experience is the same for both groups (12.99 for Portal, 12.48 for Control; $t = .89$, $p > .18$). The differences were due to the low percentages of elementary teachers in the Portal group who had obtained M.A. degrees.

Adoption and Usage

Elementary Curricula. The adoption rate, defined as percentage of persons using a curriculum during a given year, is given in Table 2 for both PSP and Control teachers. The adoption rates are very consistent and low across years for Control teachers for each curriculum. PSP teachers clearly utilized ESS and SCIS at high rates compared with the Control. Adoption rates for AAAS are little different for the two groups. Of interest is the overall adoption rate; that is, the percentage of teachers who used any one of the curricula. These data are presented in Table 3. Again, the teachers who attended one or more Portal School courses have over the past several years tended to use NSF curricula much more (66%) than the general population represented by the Control group (25%).

The length of curriculum usage was defined earlier as the number of semesters a teacher has taught a given curriculum within a given time period. The mean length for the various strata in this study are presented in Table 4. The combined yearly means are weighted averages of the rural and urban samples. Only teachers who used the curriculum at least once

TABLE 2

Elementary Curriculum Adoption Rate

Adoption rate is defined as the percentage of the sample adopting the curriculum in a given year. R = Rural U = Urban

Year	Curriculum											
	AAAS				ESS				SCIS			
	Control		Portal		Control		Portal		Control		Portal	
	R	U	R	U	R	U	R	U	R	U	R	U
1970-71	14	1	0	14	18	6	63	43	11	6	38	29
Combined	7		7		11		34		8		33	
1971-72	11	1	14	6	18	6	36	33	9	6	43	44
Combined	6		9		11		34		7		44	
1972-73	11	1	15	0	18	4	44	14	7	3	37	64
Combined	6		8		10		31		5		49	
Totals Across Years	12	1	14	7	18	6	50	33	9	6	39	52
	6		8		11		40		7		44	

TABLE 3

Adoption Rate For Any Curriculum (AAAS, ESS, or SCIS)
For Elementary Portal School and Control Teachers

Year	Portal	Control
1970-71		
Rural	63%	17%
Urban	64	3
Combined	63	9
1971-72		
Rural	79	17
Urban	61	6
Combined	69	11
1972-73		
Rural	65	28
Urban	67	6
Combined	66	15
Totals Since 1970	66	25%

TABLE 4

Length of Usage of AAAS, ESS, and SCIS
For Portal School and Control Elementary Teachers

Numbers are mean number of semesters using each curriculum;
maximum possible is 9.0 for 1970, 7.0 for 1971, and 5.0 for 1972.
R = Rural U = Urban

Year	Curriculum											
	AAAS				ESS				SCIS			
	Control		Portal		Control		Portal		Control		Portal	
	R	U	R	U	R	U	R	U	R	U	R	U
1970-71	4.00	3.00	--	9.00	3.60	2.75	5.40	7.00	2.33	3.00	3.17	7.00
Combined	3.88		9.00*		3.36		6.00		2.60		4.70	
1971-72	3.67	3.00	2.50	5.00	3.30	2.50	4.60	3.00	2.40	2.50	5.17	3.38
Combined	3.57		3.33		3.07		3.73		2.44		4.14	
1972-73	3.00	3.00	4.25	--	2.90	2.33	3.17	3.00	2.50	2.50	3.50	3.14
Combined	3.00		4.25		2.77		3.13		2.50		3.29	
Total	3.40	3.00	3.67	7.67	3.27	2.54	4.26	4.60	2.40	2.70	3.86	3.81
Combined	3.35		5.00		3.07		4.38		2.52		3.83	

*Based on only two cases

after the given year were included, so the sample sizes are considerably smaller than the initial ones. The means for AAAS are based on very small samples and must be examined with caution. Also, the number of semesters possible for implementation is smaller in succeeding years, so the combined means over years are best viewed as statistics useful for group comparisons but not as absolutes (the theoretical maximum for three years' samples or cohorts of teachers is 7.0). The ratio of observed length of use to possible length is presented in Table 5. For the Control the overall figure is about 43% and for Portal teachers is about 63%.

Analysis of variance was performed using the group mean as the unit of analysis. This produced a 3 x 2 x 2 factorial analysis (Year by Group by Urban-Rural) with one observation per cell. This was done because of the disparities in sample size and variation due to different adoption rates. Thus, the group is the unit of analysis. A main effects model was specified since no interactions were significant. Pooled residual error variance was used as the error term. Results are presented in Table 6 and support the hypothesis that Portal teachers used NSF curricula longer than the Control for AAAS, ESS, and SCIS during the five-year period. Neither urban-rural nor between-year differences were significant for any curriculum. The multivariate statistics are only approximate since an empty cell for AAAS was given a dummy value equal to an expected value for the Portal group across years within the rural stratum. The low power associated with 3,5 degrees of freedom evidently accounts for the small multivariate F-statistic.

Since teachers were asked to rate their level of usage of curricula, a weighted estimate of usage is produced by summing each semester of usage weighted by the level. Full usage, defined earlier, was given weight

TABLE 5

Length of Usage of AAAS, ESS, and SCIS as a
Ratio of Observed to Possible Number of Semester's Usage

Year	Curriculum					
	AAAS		ESS		SCIS	
	Control	Portal	Control	Portal	Control	Portal
1970-71	.43	1.00	.37	.67	.29	.52
1971-72	.51	.48	.44	.53	.35	.59
1972-73	.60	.85	.55	.63	.50	.66
Total	.48	.71	.44	.63	.36	.55

TABLE 6

Analysis of Variance Table
For Elementary Length of Usage

I. Hypothesis: Grand Mean

Multivariate F = 40.73; df = 3,5; p < .01

Univariate analyses

	df	MS	MS_{error}	F	p
AAAS*	1,7	163.38	1.47	111.16	< .01
ESS	1,6	158.05	1.06	149.70	< .01
SCIS	1,6	137.30	1.66	82.63	< .01

II. Hypothesis: Portal - Control

Multivariate F = 1.82; df = 3,5; p >.26

Univariate analyses

	df	MS	MS_{error}	F	p
AAAS*	1,7	10.35	1.47	7.04	< .06
ESS	1,6	6.44	1.06	6.10	< .05
SCIS	1,6	8.55	1.66	5.15	< .07

III. Hypothesis: Urban - Rural

Multivariate F = 2.51; df = 3,5; p >.16

Univariate analyses

	df	MS	MS_{error}	F	p
AAAS*	1,7	1.44	1.47	.97	> .35
ESS	1,6	.48	1.06	.45	> .5
SCIS	1,6	.50	1.66	.30	> .5

IV. Hypothesis: 1970-1973 Yearly Differences

Multivariate F = 1.32; df = 6,10; p >.3

Univariate analyses

	df	MS	MS_{error}	F	p
AAAS*	2,7	3.59	1.47	2.44	> .20
ESS	2,6	3.61	1.06	3.42	> .15
SCIS	2,6	.93	1.66	.56	> .60

*Univariate F-statistics constructed with two empty cells in the 1970 level. The multivariate F-statistics are therefore biased, since for missing cells estimates were inserted.

value 1.0; high usage, .667; and low usage, .333. While these numbers are necessarily arbitrary, they do reflect a differential kind of usage. Furthermore, the ratio of weighted to unweighted length is a general measure of the level of usage as a percentage of possible full usage. The weighted length and weighted-unweighted ratio are presented in Tables 7 and 8.

The Portal School teachers maintain the same relative superiority of length of usage for ESS and SCIS for weighted length of usage as was observed with unweighted length of usage. The ratio measure indicates mixed results, however. For AAAS, usage is clearly higher in the Control than in the Portal group, usage is higher for the Portal group with ESS, and usage is slightly higher in the Control for SCIS. Thus, while elementary teachers who attended Portal School workshop courses tend to use ESS and SCIS longer than the average teacher, the degree to which the curriculum is utilized is little different. For all teachers who use a curriculum, the reported level of usage is only moderate (about .55 on a scale from 0 to 1.00), indicating usage greater than just as a supplement but not generally as the primary curriculum. MANOVA was not performed since it would not add to the interpretation.

As an additional question, Portal teachers were asked if they were presently teaching in a school different from the one they had taught in when they took the Portal School course, and they were asked to write the address of their former school. These schools were sent the same material as the Control sample. From 21 elementary questionnaires sent, 18 were returned for an 86% response rate. Adoption rates for these schools were 17% for AAAS, 56% for ESS, and 61% for SCIS--all higher than the Control or Portal samples. The mean length of usage in semesters was higher than the Control but similar to the 1970 Portal group for all

TABLE 7

Weighted Length of Usage of AAAS, ESS, and SCIS
For Portal School and Control Teachers

Numbers are the mean number of semesters' usage of each curriculum weighted by level of use. Low = .33, High = .67, Full = 1.00.
R = Rural U = Urban

Year	Curriculum											
	AAAS				ESS				SCIS			
	Control		Portal		Control		Portal		Control		Portal	
	R	U	R	U	R	U	R	U	R	U	R	U
1970-71	3.0	1.0	--	6.0	1.67	1.17	3.70	4.28	1.50	1.25	1.67	4.33
Combined	2.75		6.0		1.52		3.92		1.40		2.73	
1971-72	3.22	1.0	1.67	1.67	1.17	1.08	2.60	.89	1.67	1.08	1.89	1.54
Combined	2.90		1.67		1.14		1.67		1.41		1.69	
1972-73	2.56	1.0	1.42	--	1.43	1.11	1.72	2.56	1.75	1.00	1.67	1.55
Combined	2.33		1.42		1.36		1.89		1.50		1.60	
Totals Across Years (weighted by sample size)	2.93	1.0	1.50	4.56	1.42	1.14	2.62	2.58	1.62	1.13	1.73	1.97
	2.83		2.52		1.34		2.61		1.42		1.86	

TABLE 8

Elementary Curriculum Usage Levels of AAAS, ESS, and SCIS
For Portal School and Control Teachers

The usage level means below have been computed by dividing the weighted mean length (Table 6) by the unweighted mean length (Table 4) for each group.
R = Rural U = Urban

Year	Curriculum											
	AAAS				ESS				SCIS			
	Control		Portal		Control		Portal		Control		Portal	
	R	U	R	U	R	U	R	U	R	U	R	U
1970-71	.75	.33	—	.67	.46	.43	.69	.61	.64	.42	.53	.62
Combined	.71		.67		.45		.65		.54		.58	
1971-72	.88	.33	.67	.33	.35	.43	.57	.30	.70	.43	.37	.46
Combined	.81		.50		.37		.45		.58		.41	
1972-73	.85	.33	.33	—	.49	.48	.54	.85	.70	.40	.48	.49
Combined	.78		.33		.49		.60		.60		.49	
Combined Across Years	.86	.33	.41	.59	.43	.45	.60	.59	.68	.42	.45	.52
	.80		.50		.44		.60		.56		.49	

three curricula (AAAS, 8.0; ESS, 5.88; SCIS, 4.27). Also, weighted length of usage and usage level were higher than the average in either Control or 1970-71 Portal teachers for all three curricula (AAAS, weighted length = 6.67, usage level = .83; ESS, 4.11, .70; SCIS, 3.18, .74). The higher numbers associated with these schools are merely correlates and do not imply causation, but they are a possible indicator of the effect of specific training (Portal School Project) which remains in a building even after the individual teacher leaves. The selection threat remains as an alternative: Portal teachers come from schools which tend to implement NSF curricula at a higher rate and for longer periods of time.

Secondary Curricula. The adoption percentages for junior and senior high teachers, stratified by Portal-Control, year, and urban-rural location, are given in Table 9. Overall, very little difference is noted in adoption percentage between Portal and Control teachers in junior high, although ISCS was chosen more by Portal teachers in general, while Control teachers at the senior high level utilized BSCS more than did Portal teachers. No difference is observed between Portal and Control teachers for adoption of ESCP for 1970, but Control teachers utilized ESCP more thereafter.

The general measure of adoption, those teachers using any curriculum of the three at any time, is presented in Table 10. Very little difference exists between Portal and Control teachers for adoption at any given time, although overall Control senior high teachers have utilized the three curricula at a higher rate than Portal senior high teachers since 1970.

The mean length of usage in semesters for the various groups is presented in Table 11. Looking at observed length of usage in terms of the percentage of possible semester's usage, given in Table 12, it is apparent

TABLE 9

Secondary Curriculum Adoption Rate

Jr = Junior High School
Sr = Senior High School

Year	Curriculum											
	BSCS				ESCP				ISCS			
	Control		Portal		Control		Portal		Control		Portal	
	Jr	Sr	Jr	Sr	Jr	Sr	Jr	Sr	Jr	Sr	Jr	Sr
1970-71												
Rural	20	69	9	60	38	38	36	40	16	27	73	20
Urban	29	71	--*	--*	26	0	--*	--*	23	1	—*	--*
Combined	23	70	9	60	34	23	36	20	18	17	73	20
1971-72												
Rural	20	69	28	65	32	38	0	24	16	23	29	18
Urban	29	65	25	20	26	0	17	0	23	0	33	10
Combined	24	67	26	48	30	23	11	15	18	14	32	15
1972-73												
Rural	18	69	11	36	29	35	6	18	16	23	11	18
Urban	29	59	10	38	19	0	30	0	23	0	40	8
Combined	22	65	10	37	25	21	14	9	18	14	21	13
Totals Across Years	23	70	16	43	34	23	17	14	18	17	36	14

*No urban Portal School courses were conducted

TABLE 10

Adoption Rate for Any Curriculum (BSCS, ESCP, ISCS)
For Secondary Portal School and Control Teachers
During or After a Given Year

Adoption rate is defined as the percentage
of the sample adopting the curricula.

Year	Portal	Control
1970-71		
Junior High		
Rural	91%	47%
Urban	--*	40
Combined	91	44
Senior High		
Rural	60	55
Urban	--*	70
Combined	60	63
1971-72		
Junior High		
Rural	33	48
Urban	40	57
Combined	38	53
Senior High		
Rural	67	64
Urban	62	75
Combined	65	69
1972-73		
Junior High		
Rural	40	50
Urban	70	57
Combined	55	54
Senior High		
Rural	47	61
Urban	40	75
Combined	43	68
Totals Since 1970		
Junior High	57	55
Senior High	55	73

*No urban Portal courses were conducted

TABLE 11

Length of Usage of BSCS, ESCP, and ISCS
For Portal School and Control Secondary Teachers

Numbers are mean number of semesters using each curriculum;
maximum possible is 9.0 for 1970, 7.0 for 1971, and 5.0 for 1972.

Year	Curriculum											
	BSCS				ESCP				ISCS			
	Control		Portal		Control		Portal		Control		Portal	
	Jr	Sr	Jr	Sr	Jr	Sr	Jr	Sr	Jr	Sr	Jr	Sr
1970-71												
Rural	6.64	6.33	1.0	9.0	5.19	5.6	7.75	6.5	3.67	4.29	--	6.0
Urban	8.33	7.92	--	--	6.0	--	--	--	5.57	1.0	--	--
Combined	7.40	6.97	1.0	9.0	5.41	5.6	7.75	6.5	4.50	3.88	--	6.0
1971-72												
Rural	5.36	4.89	4.5	5.45	4.33	4.5	--	6.25	3.44	4.83	6.0	4.33
Urban	6.56	6.45	7.0	4.0	4.75	--	7.0	--	5.29	--	5.25	1.0
Combined	6.09	5.54	6.0	5.23	4.46	4.5	7.0	6.25	4.25	4.83	5.50	3.5
1972-73												
Rural	4.2	3.33	3.0	4.50	3.38	3.33	5.0	5.0	3.11	3.0	5.0	4.0
Urban	4.78	4.90	5.0	4.2	4.67	--	3.33	--	4.43	--	2.25	2.0
Combined	4.47	3.89	3.67	4.33	3.73	3.33	3.75	5.0	3.75	3.0	3.17	3.33
Totals Across Years	6.01	5.50	4.67	5.42	4.66	4.51	5.90	5.92	4.17	3.55	5.20	3.25

TABLE 12

Rate of Usage of Secondary Curricula as a
Ratio of Observed to Possible Length of Usage in Semesters

Year	Curriculum											
	BSCS				ESCP				ISCS			
	Control		Portal		Control		Portal		Control		Portal	
	Jr	Sr	Jr	Sr	Jr	Sr	Jr	Sr	Jr	Sr	Jr	Sr
1970-71	82	77	11	100	60	62	86	72	50	43	—	67
1971-72	87	79	86	75	64	64	100	89	61	69	79	50
1972-73	89	78	73	87	75	67	75	100	75	60	63	67
Totals	86	79	67	77	67	64	84	85	60	51	74	46

that secondary curricula, once adopted, are utilized for over half the time possible in the Control for all curricula. Once teachers adopt a secondary curriculum they use it a great deal in subsequent years. Analysis of variance was used to look for differences in length of usage based on Table 11, and results are given in Table 13. Although the multivariate results are only approximate due to the missing cells for various curricula, the Portal-Control differences are clearly significant both for the multivariate and univariate analyses, although in opposite directions. For BSCS, Control used it longer; for ESCP, the Portal teachers used it longer; and for ISCS, there was no difference. No consistent results were observed for the urban-rural or junior-senior high factors. Cross-year differences emerge as expected for secondary teachers, with teachers who have had a longer time to use curricula doing so.

Of ten Portal teachers who had moved since attending their workshops, teachers in eight schools where the teachers originally taught responded. This sample size is too small to provide generalizability. Six of the eight have used one of the three curricula at least once since the Portal teacher left. The length of usage is high for all three curricula (BSCS, 6.5; ESCP, 9.0; ISCS, 9.0), indicating usage prior to or concurrent with the Portal workshops. No inference about persistence in schools where workshop trained teachers have taught and then left is warranted.

Decay in Usage Over Time

Another question of interest to curriculum developers and planners is the expectancy of length of usage by adopters. Teachers who utilized curricula at least once were the initial population. The percentages of teachers who utilized the curricula one semester, two, three, etc., were computed for the 1970-71 cohort, the 1971-72 cohort, 1972-73 cohort, and

TABLE 13

Analysis of Variance Tables for Secondary Persistence in Usage of BSCS, ESCP, and ISCS

Design: Year (3 levels) x Group (2 levels) x Urban-Rural (2 levels) by Jr-Sr (2 levels)

Hypothesis I: Grand Mean

Multivariate F = 47.34; df = 3,13; p < .01

	df	MS	MS_{error}	F	p
BSCS	1,15	625.85	2.33	228.1	< .01
ESCP	1,10	426.22	.569	748.78	< .01
ISCS	1,13	291.80	2.05	142.31	< .01

Hypothesis II: Urban-Rural Differences

Multivariate F = 1.72; df = 3,13; p > .20

	df	MS	MS_{error}	F	p
BSCS	1,13	9.21	2.33	3.95	< .07
ESCP	1,10	.099	.569	.17	> .68
ISCS	1,13	4.44	2.05	2.17	> .16

Hypothesis III: Portal-Control Differences

Multivariate F = 8.31; df = 3,13; p < .01

Univariate	df	MS	MS_{error}	F	p
BSCS	1,13	1.75	2.33	.75	> .40
ESCP	1,10	7.39	.569	12.99	< .01
ISCS	1,13	.27	2.05	.13	> .72

Hypothesis IV: Jr-Sr High Differences

Multivariate F = 4.25; df = 3,13; p < .03

Univariate	df	MS	MS_{error}	F	p
BSCS	1,13	1.22	2.33	.52	> .48
ESCP	1,10	.030	.569	.052	> .82
ISCS	1,13	8.42	2.05	4.11	< .06

Hypothesis V: Cross-Year Differences

Multivariate F = df = p

Univariate	df	MS	MS_{error}	F	p
BSCS	2,13	9.29	2.33	3.98	< .05
ESCP	2,10	6.11	.569	10.73	< .01
ISCS	2,13	4.44	2.05	2.17	> .16

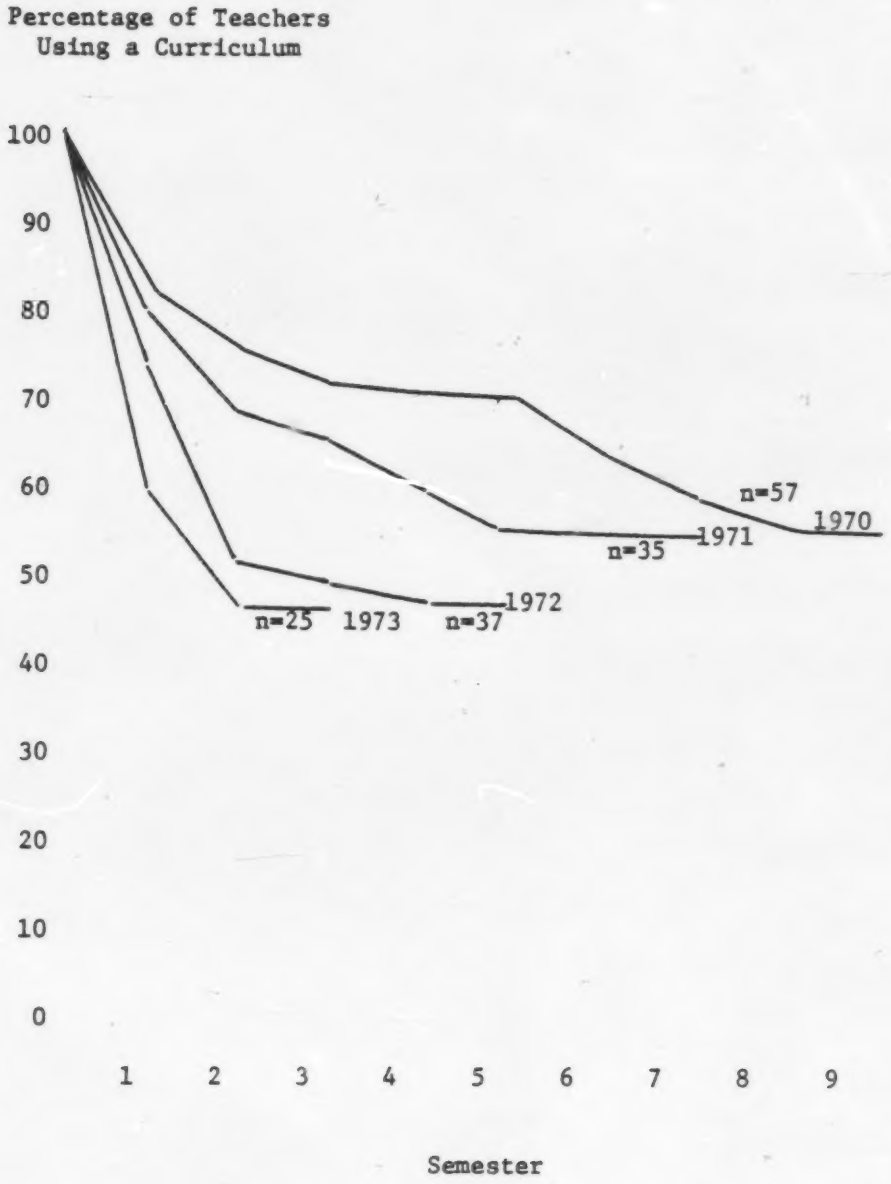
the 1973-74 cohort. The resultant curves show the characteristics of exponential decay, given in Figures 1-3. These curves were computed for elementary teachers combining all three curricula, since the curves for each curriculum and for Portal and Control teachers were quite similar. ESCS is shown separately, since its curve is different from ESCP or ISCS which, being similar, were combined. The 1970 cohorts generally have the greatest sample size and most time points so that they represent the most stable curves. While a time effect may be present, the curves appear to level off at very similar percentages. It is probable that these curves will again drop after a few more years due to inevitable attrition factors in the teaching profession, but the curves are at least suggestive of five-year patterns of usage.

As an example, the elementary curve in Figure 1 would lead a developer to expect that in five years about 80% of a group of adopting teachers would use the curriculum at least one semester, 75% would use it a year, and over 50% would use it for the full five years. Note that these figures are based on adoption at any time within the period and usage for non-continuous as well as continuous patterns. Thus, for the decay curves shown, a teacher was included if (s)he adopted at least once at any time. Subsequent use could be the next semester, or any succeeding semester.

Discussion

The patterns of curriculum adoption and subsequent use over a five-year period represent initial work to characterize length of usage by teachers. The data associated with the Control group may be regarded as norm data for comparison purposes, since the stratified random selection procedure is thought to be representative of at least the western U.S.

Figure 1: Nine Semester Usage Curves for Teachers Who Utilize an Elementary Science Curriculum (AAAS, ESS, or SCIS) at Least Once.



n = sample size
year = cohort year

Figure 2: Nine Semester Usage Curve for Teachers Who Use BSCS at Least Once.

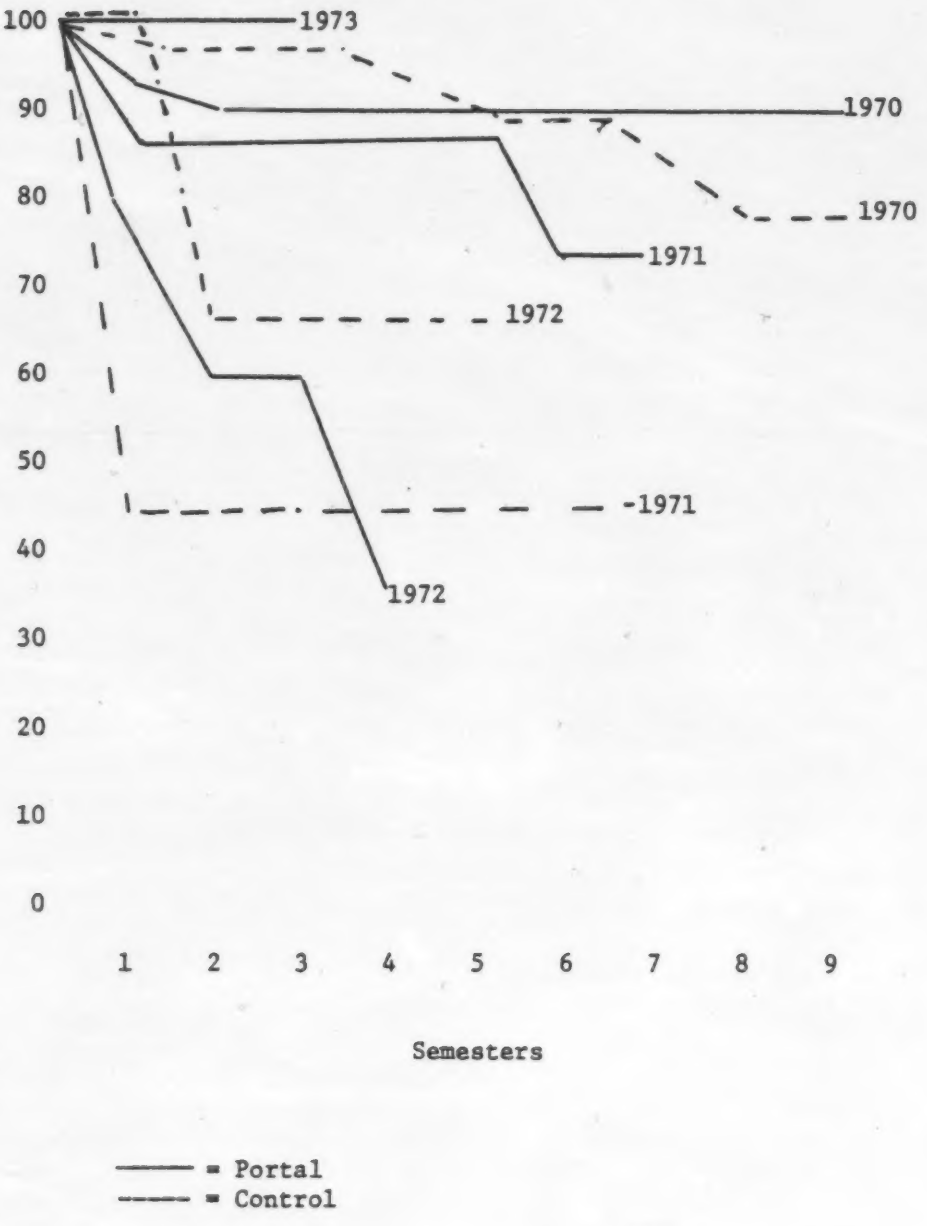
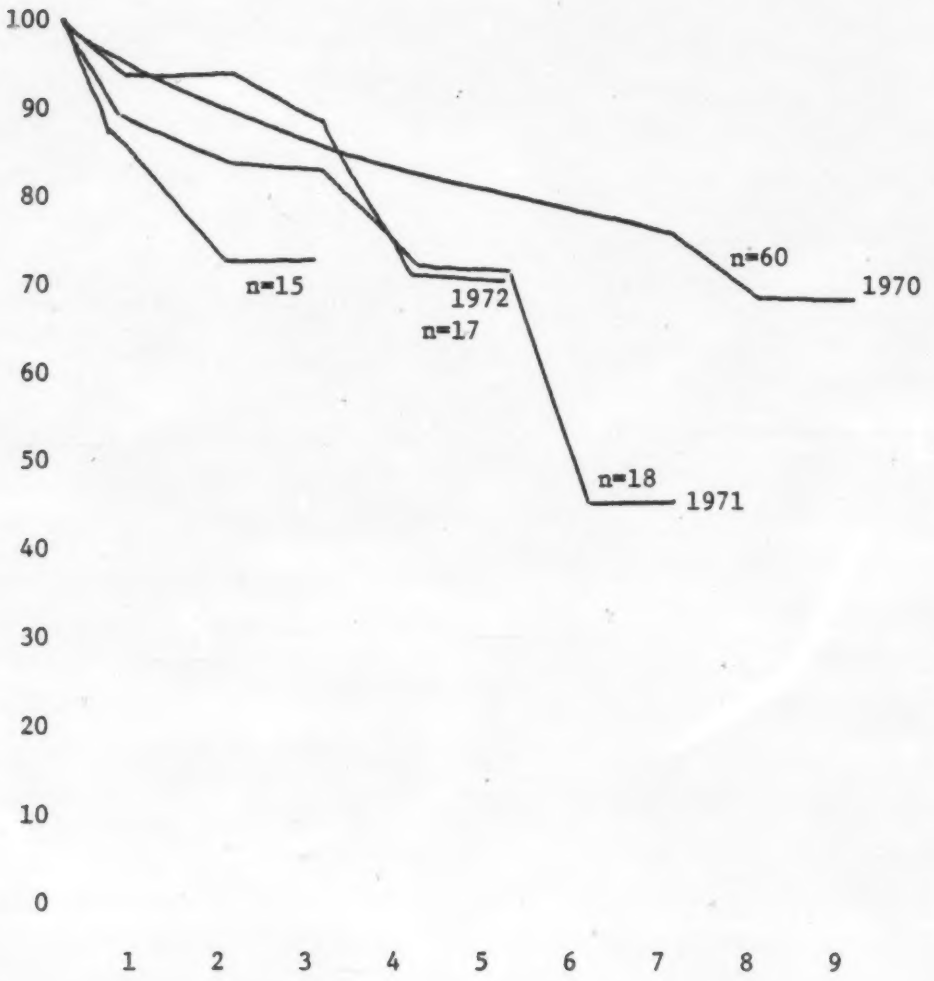


Figure 3: Nine Semester Usage Curves for Teachers Who Utilize ESCP or ISCS at Least Once.



Note: Portal and Control samples were combined since the decay curves were quite similar.

population of teachers. The adoption rates recorded with this sample agree well with those of Schlessinger, et al.(1973) for the region sampled. Length of usage of elementary curricula is fairly stable. Adopters can be expected to use a curriculum about 40% of a four and one-half year period. Secondary persistence is even greater in terms of expected usage over time, about 68% over four and one-half years.

The purpose in comparing the Portal School teachers with the Control group was to see if longer persistence is associated with the general training in a curriculum exemplified by the Portal workshops. While many workshops were very general and the selection factor is ever-present, the several analyses presented clearly show that the Portal group tends to utilize NSF sponsored curricula longer than the Control sample, independent of adoption rate.

Reasons for the above outcomes are conjectural rather than definitive. This study was not a controlled experiment. The Portal teachers may be different in their motivation and interest, although experience was about the same for both groups. The lure of academic credit may have been important since the Portal teachers had fewer M.A.'s than the Control. District commitment to a curriculum certainly played a role in Portal School attendance by teachers, so that continued curriculum usage may not have been voluntary. Some of the data in this study tend to discount this reason, however, because Portal teachers' reported level of usage was lower than the Control's, indicating Portal teachers were using the NSF curricular materials as supplements to other curricula. This indicates interest in NSF curricula even when others may be required or preferred, rather than district-imposed use of NSF curricula.

Another possible reason for Portal-Control differences is that the familiarity with a curriculum induced through the Portal workshops produced the longer usage. If this is so, and it is considered desirable for teachers to continue to utilize materials such as the NSF curricula, then the promulgation of teacher familiarization and in-depth study by means of in-service workshops is an important part of a curriculum implementation program. Whether NSF or private developers carry out this program is irrelevant. Workshops and institutes appear to help in the maintenance of a curriculum once adopted.

The decay curves presented are descriptive in nature and are intended to give other researchers norms with which to compare their data. The curves level off at very high points, but this may be a function of the time span to which the study was limited--four and one-half years. A ten-year follow-up may give very different results.

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